FACT SHEET

Hazards of Hydrolysate

The Newport Chemical Agent Disposal Facility (NECDF) has been designed and constructed to safely destroy more than 1,200 tons of liquid nerve agent VX currently stockpiled at the Newport Chemical Depot (NECD) in Newport, Indiana. The NECDF will use a chemical neutralization process called caustic hydrolysis in which VX (8-33 percent by weight) will be mixed and then heated in a reactor with sodium hydroxide and water. The byproduct of the neutralization process is a caustic organic-salt wastewater called hydrolysate. This caustic wastewater will require additional treatment before final disposal. The Army's preferred option for final disposition of the hydrolysate is transportation to a permitted commercial hazardous waste facility where it will undergo additional treatment before final disposal. Commercial hazardous waste treatment facilities treat materials with similar characteristics to the caustic wastewater generated at the Newport site on a routine basis. These commercial facilities have the experience and expertise to properly treat the caustic wastewater.

The Army has made a commitment to the public that hydrolysate will not leave the NECDF until the on-site laboratory confirms that the hydrolysate is non-detect for VX, with a Method Detection Limit of less than or equal to 20 parts per billion.

The following paragraphs describe the expected hazards associated with hydrolysate.

FLAMMABILITY

The flammability hazard associated with the caustic wastewater, produced at a 33 percent agent loading, relates to the presence of an organic upper layer with a flashpoint of 127 degrees Fahrenheit. The flashpoint is the temperature to which a liquid must be heated before the vapors from the liquid will ignite in the presence of an ignition source (e.g., flame, spark, etc.). The flashpoint for 33 percent loading hydrolysate is similar to that of acetic acid, a major component in vinegar. The upper layer corresponds to approximately three to five percent (by volume) of the total hydrolysate.

However, under the current expected operation conditions in which less VX will be neutralized per hydrolysate batch (8-16 percent agent loading by weight), testing has shown that the flammability is eliminated.

CORROSIVENESS

Excess sodium hydroxide is present at approximately three to five percent by weight in the caustic wastewater (hydrolysate). (NOTE: Fifty percent sodium hydroxide is commonly shipped throughout the United States daily.) Chemical burns to the skin are the greatest risk of hydrolysate because of the caustic nature of the sodium hydroxide.

TOXICITY

The neutralization of VX results in breakdown products that include the sodium salts of EA 2192, EMPA, MPA, and thiolamine. In their pure form, and by themselves, these individual compounds possess their own toxicities. However, in order to get a true picture of the toxicity of a solution like hydrolysate that contains small amounts of these various compounds, it is necessary that toxicity studies be performed on the hydrolysate itself in order to determine the overall effect of the combination of these compounds. That is why, as part of the overall development program, the Project Manager for Alternative Technologies and Approaches evaluated the toxicity of the liquid waste as a whole. These tests were performed with the original 33 percent agent loading neutralization process. As mentioned previously, current expectations for operating conditions are with an agent loading of 8-16 percent.

The dermal (skin) and oral toxicity of wastewater was evaluated in February 1999 according to Department of Transportation test procedures. This testing established that hydrolysate did not qualify as a poison or as a corrosive capable of damaging skin and producing gastrointestinal injury, as would be expected for similar caustic solutions.

For more information,
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Hazards of Hydrolysate (continued)

With the implementation of a reduced agent loading (8-16 percent) neutralization process, except with respect to caustic, the concentrations of all other reaction byproducts will be from two to four times less than in the (33 percent agent-loaded) hydrolysate. This reduction in the relative contribution of the reaction byproducts will substantially diminishes the hazards posed by exposure to the caustic wastewater.

CONCLUSION

The Army, as part of the development program, had oral and dermal (skin) toxicity studies performed on the hydrolysate. The key findings were that the liquid waste no longer exhibited any agent characteristics. In fact, the toxicity and hazard of the hydrolysate were found to be directly related to the corrosive nature of the solution, as would be expected for any similar caustic solutions.

In addition, it must be emphasized that oral exposure is the least likely exposure pathway for the caustic wastewater—no one is going to drink hydrolysate. With respect to dermal (skin) contact hazards, the major hazard associated with the material is its residual caustic concentration. This property makes hydrolysate extremely corrosive to the skin and could result in severe burns. There is a skunky odor associated with hydrolysate. This characteristic odor, though unpleasant, is not a hazard. Therefore, as consistently stated by the Army throughout the life of the project, the caustic/corrosive nature of the wastewater poses the most significant hazard. Consequently, splash protection (e.g., gloves, boots, protective clothing, etc.) and respiratory protection (i.e., self-contained breathing apparatus) from caustic vapors is needed when handling hydrolysate.